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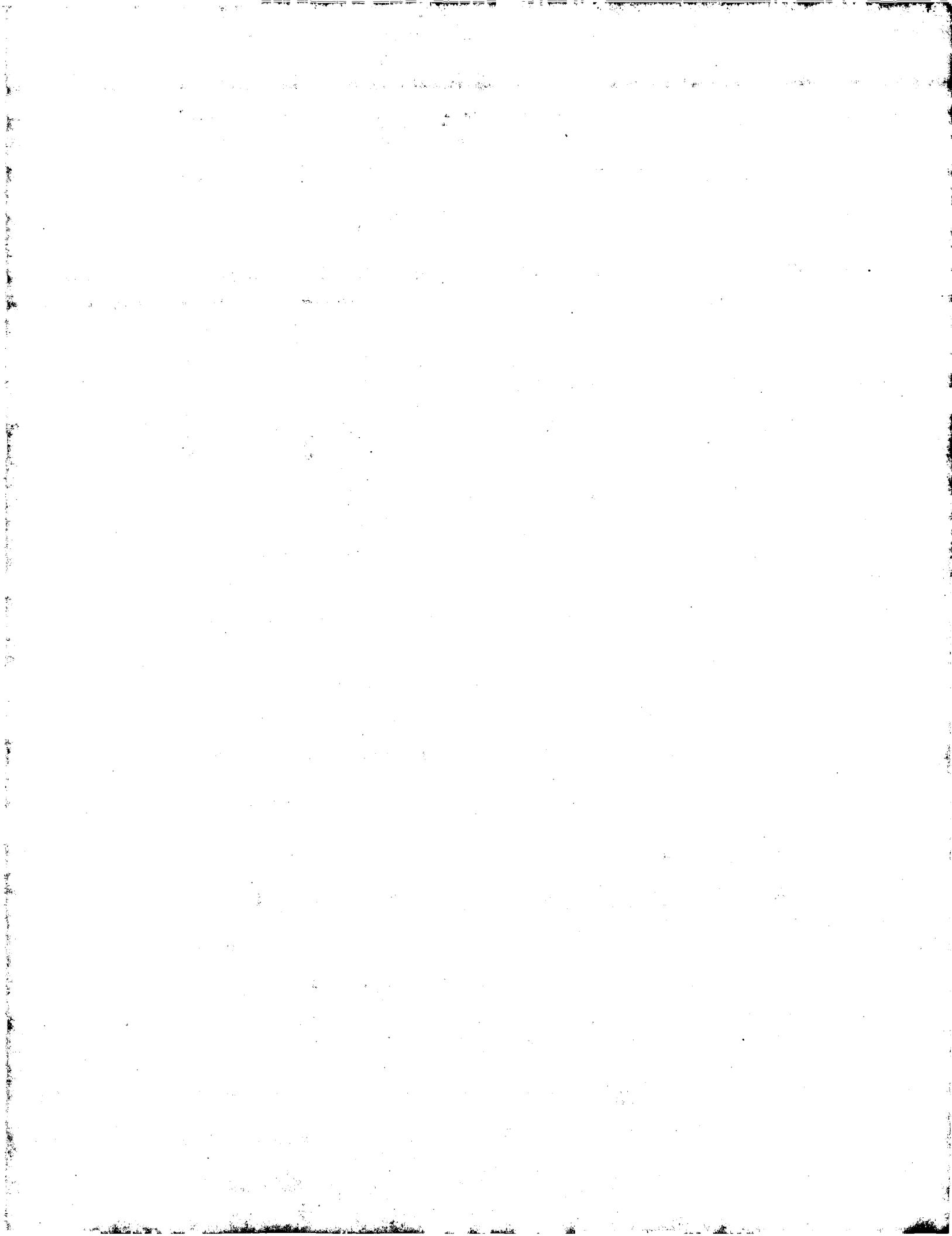
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(54) Title: APPARATUS FOR FEEDING SHEET MATERIAL	<p>Published <i>With international search report.</i></p>
(57) Abstract	<p>There is disclosed apparatus for feeding sheet material (S) sequentially on demand to processing machinery having a take-up mechanism (12) comprising a feed table (10) having a gate (11) and upon which the sheets (S) may be stacked against the gate (11) which allows only the lowermost sheet (S) to pass therebeneath, a bed (13) of rollers (14) within the surface of the table (10) which may be rotatably driven to advance the lowermost sheet (S) beneath the gate (11) to the take-up mechanism (12) when forward drive to the rollers (14) is arrested and means to allow the rollers (14) to free-wheel once the lowermost sheet (S) is being advanced thereover by said take-up mechanism (12) and vacuum suction means (30) behind the rollers (14) to hold the next lowermost sheet (S) against the action of the free-wheeling rollers (14) after the sheet (S) being fed has passed under the gate (11).</p>

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APPARATUS FOR FEEDING SHEET MATERIAL

This invention concerns apparatus for feeding sheet material, particularly, though by no means exclusively, of corrugated board or card as used in the box and carton making industries.

In general, stacked sheets are placed on a feed table against a gate which allows only the lowermost sheet to pass therebeneath under the action of a reciprocating vacuum suction cup, feed rollers or a kicker mechanism, to be taken into the nip of take-up rolls. Such feeding arrangements must be controlled with great precision and even then misfeeds are a not uncommon experience.

One solution to these problems is proposed in my British Patent No. 2 274 276, but this involves reciprocating movement of the entire roller bed, which is not energy efficient and places certain restrictions on sheet size.

According to the present invention there is provided apparatus for feeding sheet material sequentially on demand to processing machinery having a take-up mechanism comprising a feed table having a gate and upon which the sheets may be stacked against the gate which allows only the lowermost sheet to pass therebeneath, a bed of rollers within the surface of the table which may be rotatably driven to advance the lowermost sheet beneath the gate to the take-up mechanism when forward drive to the rollers is arrested and means to allow the rollers to free-wheel once the lowermost sheet is being advanced thereover by said take-up mechanism and vacuum suction means behind the rollers to hold the next lowermost sheet against the action of the free-wheeling rollers after the sheet being fed has passed under the gate.

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The take-up mechanism may comprise take-up rolls.

The rollers may be fitted with sprag clutches and may advance the sheet being fed at a slower speed than that of the take-up mechanism.

Vacuum suction may be applied from beneath the rollers to pull the lowermost sheet downwardly thereagainst.

The invention will be further apparent from the following description with reference to the figures of the accompanying drawings, which show, by way of example only, two forms of sheet feeding apparatus embodying same.

Of the drawings:-

Figure 1 shows a side elevation of a first form of apparatus;

Figure 2 shows a cross-section through the apparatus on the line II-II of Figure 1; and

Figure 3 shows a side elevation of a second form of apparatus.

Referring now to Figures 1 and 2 it will be seen that the apparatus comprises a feed table 10 upon which a stack of sheets S may be placed against a gate 11 beneath which only the lowermost sheet in the stack may pass.

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Successive sheets are advanced beneath the gate 11 into the nip of take-up rolls 12 by a bed 13 of rollers 14 within the surface of the table. The take-up rolls 12 forward the successive sheets in timed sequence to processing machinery such as a rotary die-cutter.

The rollers are mounted within a chamber 15 to which vacuum suction is applied to pull the lowermost sheet downwardly thereagainst.

The rollers 14 advance the lowermost sheet by being rotatably driven as indicated by the arrows X at a speed equal to or less than the speed of the take-up rolls 12. Once the sheet is advanced by the rolls 12 and rollers 14 free-wheel, the rollers 14 having sprag clutches between their inner peripheries and their drive shafts 16.

At least during this free-wheeling stage forward drive to the rollers 14 is arrested and a vacuum chamber 30 behind the rollers 14 is exhausted to hold the next lowermost sheet in a fixed position against the action of the free-wheeling rollers after the sheet being fed has passed under the gate 11 to leave an opening through which the next sheet could otherwise prematurely pass. The chamber 30 can be exhausted continuously or cyclically.

The drive shafts 16 are rotatably interconnected by timing drive belts 17 and one shaft is driven by a timing belt 18 itself driven intermittently in a forward direction only by a servo-electric motor 21 which stops whilst a sheet is being advanced by the take-up rolls 12 and which operates at a timed sequence demanded by the processing machinery.

The arrangement of Figure 3 is generally similar, like parts being indicated by like reference numerals. In this embodiment, however, the timing belt 18 is driven

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by a timing belt 19 reciprocated by an arm 20 operating in time with the processing machinery. Thus the shafts 16 of the rollers 14 are driven in reverse direction during the time that the rollers 14 are free-wheeling.

It will be appreciated that it is not intended to limit the invention to the above example only, many variations, such as might readily occur to one skilled in the art, being possible, without departing from the scope thereof as defined by the appended claims.

Other drive mechanisms are possible such as from a reciprocating cam imitating the movement of the arm 20 of Figure 3.

CLAIMS

1. Apparatus for feeding sheet material sequentially on demand to processing machinery having a take-up mechanism comprising a feed table having a gate and upon which the sheets may be stacked against the gate which allows only the lowermost sheet to pass therebeneath, a bed of rollers within the surface of the table which may be rotatably driven to advance the lowermost sheet beneath the gate to the take-up mechanism when forward drive to the rollers is arrested and means to allow the rollers to free-wheel once the lowermost sheet is being advanced thereover by said take-up mechanism and vacuum suction means behind the rollers to hold the next lowermost sheet against the action of the free-wheeling rollers after the sheet being fed has passed under the gate.
2. Apparatus according to claim 1 wherein the take-up mechanism comprises take-up rolls.
3. Apparatus according to claim 1 or claim 2 wherein the rollers are fitted with sprag clutches and advance the sheet being fed at a slower speed than that of the take-up mechanism.
4. Apparatus according to any one of claims 1-3 wherein vacuum suction is applied from beneath the rollers to pull the lowermost sheet downwardly against the rollers.
5. Apparatus according to any one of claims 1 to 4 wherein the rollers are driven by a servo electric motor which alternately drives the rollers forwardly and stops, the timing of the motor being controlled by the processing machinery.

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6. Apparatus according to any one of claims 1-4 wherein the rollers are rotably interconnected by timing drive belts and one is driven by a further timing drive belt reciprocated by an arm operating in time with the processing machinery.
7. Apparatus according to claim 6 wherein said further drive belt is toothed.

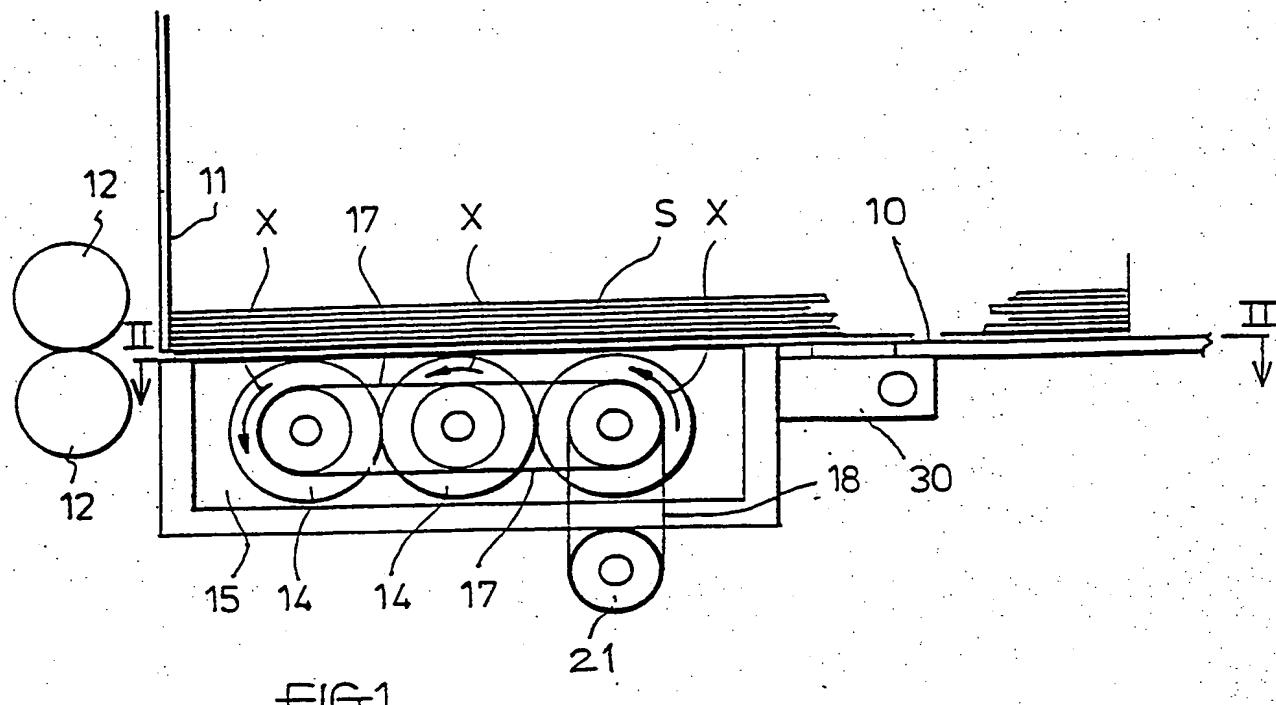


FIG.1

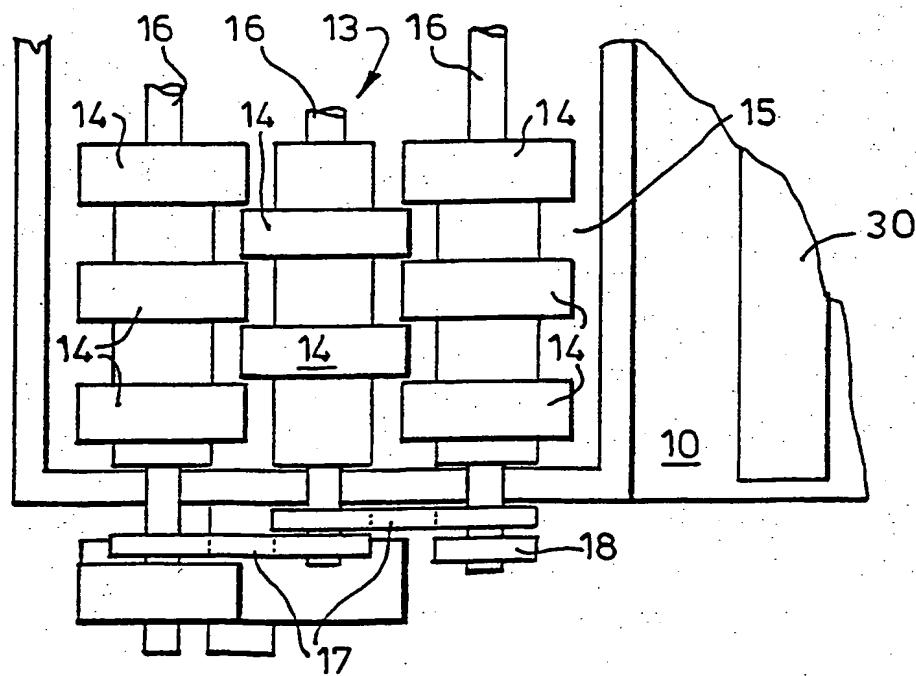
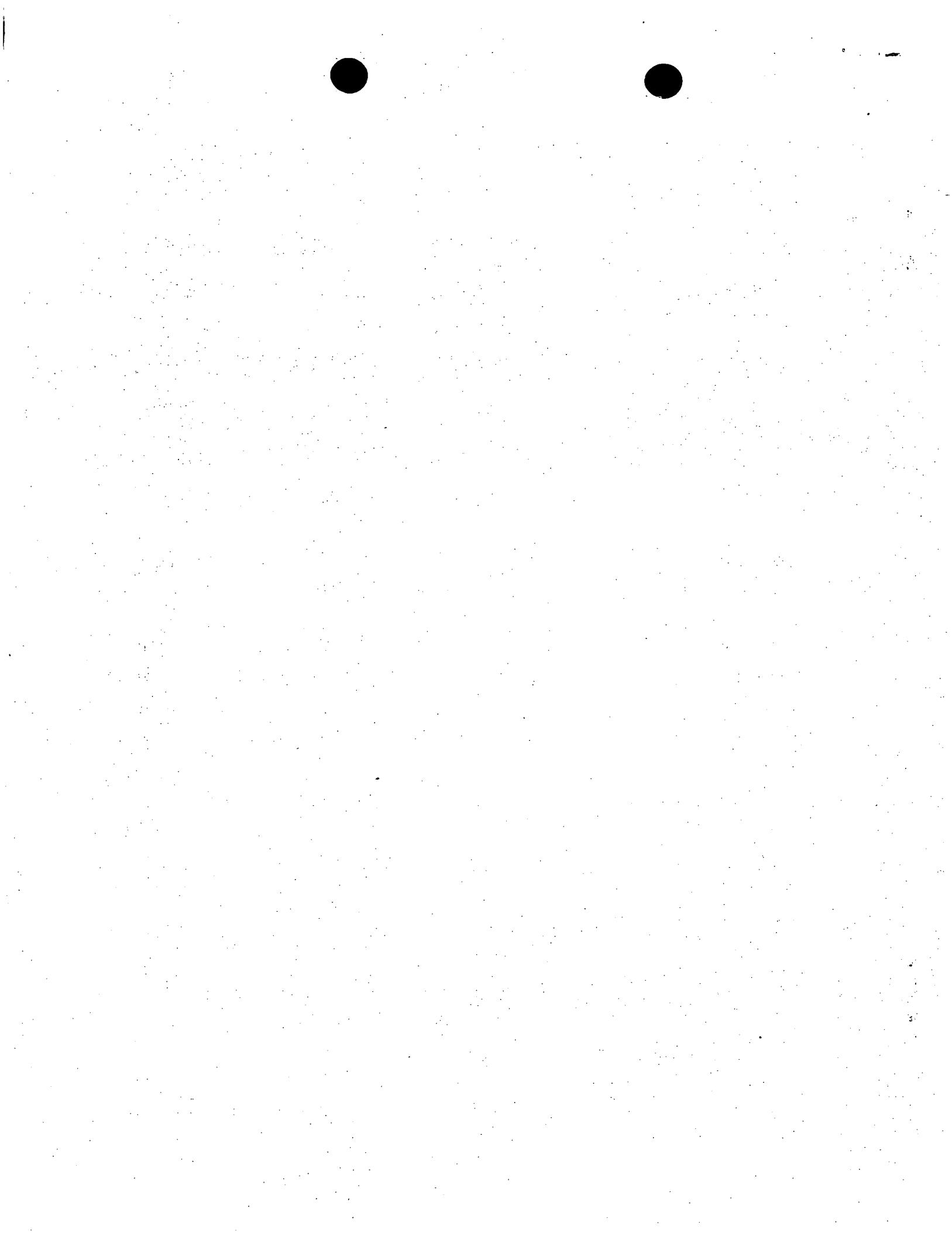


FIG.2



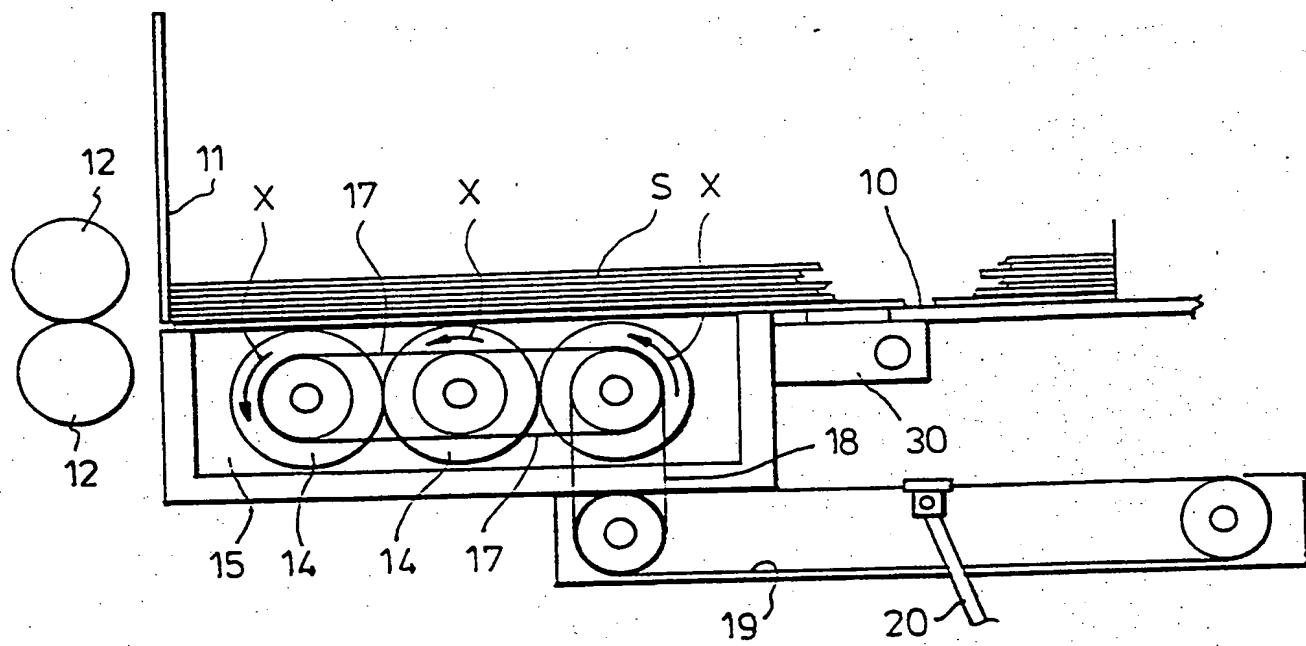


FIG.3

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INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 99/01010

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65H3/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 96 29269 A (SULLIVAN JOHN ANTHONY) 26 September 1996 (1996-09-26) the whole document ---	1-7
Y	US 4 648 587 A (HIROMORI KUNIO ET AL) 10 March 1987 (1987-03-10) column 2, line 21 - line 43; figure 1 ---	1-7
A	EP 0 794 140 A (MITSUBISHI HEAVY IND LTD) 10 September 1997 (1997-09-10) column 13, line 54 -column 15, line 33; figures 6,7 ---	1,5

Further documents are listed in the continuation of box C.

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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9629269	A 26-09-1996	AU 691655 B AU 3395895 A BR 9510535 A CA 2213447 A CN 1175237 A DE 69508439 D DE 69508439 T EP 0815045 A JP 11502182 T		21-05-1998 08-10-1996 01-06-1999 26-09-1996 04-03-1998 22-04-1999 08-07-1999 07-01-1998 23-02-1999
US 4648587	A 10-03-1987	JP 1514454 C JP 59177227 A JP 63064367 B		24-08-1989 06-10-1984 12-12-1988
EP 0794140	A 10-09-1997	JP 2836933 B JP 4106050 A AU 651785 B AU 4478893 A AU 8015591 A DE 69127859 D DE 69127859 T EP 0465355 A US 5172898 A US 5219157 A AU 643302 B		14-12-1998 08-04-1992 28-07-1994 18-11-1993 09-01-1992 13-11-1997 05-02-1998 08-01-1992 22-12-1992 15-06-1993 11-11-1993